CLAIMS

1. An image display system comprising:

display means for displaying a series of images along the path of a vehicle;

lighting for briefly illuminating individual images;

at least one detector to output repeated measurements of the speed of a passing vehicle; and,

control means arranged to control the lighting to illuminate images successively as the vehicle passes at illumination timings based on the position of the vehicle along the said path;

wherein the control means comprises processing means including a first system arranged to process the repeated speed measurements to produce an instantaneous estimate of the position of the vehicle along the said path, and a second system arranged to derive the illumination timings from the instantaneous estimate of the position of the vehicle.

2. An image display system as claimed in Claim 1 wherein the said first system is arranged to implement first, second, third or higher order polynomial solutions to the equation of motion.

3. An image display system as claimed in Claim 2 wherein the first system comprises a plurality of cascaded registers, including a first register arranged to be loaded with instantaneous values derived from the said repeated speed measurements and a second register arranged to be loaded with values representing the instantaneous

position of the vehicle.

4. An image display system as claimed in Claim 3 wherein the said first system further comprises a means for adding the instantaneous values of the said first and second registers for repeatedly updating the second register, and a third register arranged to implement a time delay function on the output from the said adding means before the second register is updated.

5. An image display system as claimed in Claim 4 wherein the time delay function of the third register is determined such that the second register is periodically updated at least once every 50 microseconds.

6. An image display system as claimed in Claim 4 or Claim 5 wherein the instantaneous values of the said first register represent the distance travelled by the vehicle in the instant cycle.

7. An image display system as claimed in Claim 6 wherein the instantaneous values of the first register are scaled values of the measured speed of the vehicle.

8. An image display system as claimed in any of Claims 3 to 7 wherein the first system further comprises a fourth register arranged to be loaded with values representing the instantaneous acceleration of the vehicle.

9. An image display system as claimed in Claim 8 wherein the said means for

adding comprises a first means for adding and the said first system further comprises a second means for adding the instantaneous values of the said first and fourth registers for repeatedly updating the first register, and a fifth register arranged to implement a time delay function on the output from the second adding means before the first register is updated.

10. An image display system as claimed in Claim 9 wherein the time delay function of the fifth register is determined such that the first register is periodically updated at least once every 50 microseconds.

11. An image display system as claimed in Claim 9 or Claim 10 wherein the instantaneous values of the said fourth register represent the change in speed of the vehicle in the instant cycle.

12. An image display system as claimed in Claim 10 when indirectly dependent on Claim 5 wherein the third and fifth registers are synchronised and implement the same time delay function

13. An image display system as claimed in Claim 12 wherein the time delay or clocking period of the third and fifth registers is less than 20 microseconds.

14. An image display system as claimed in any preceding claim wherein the said detector is arranged to operate asynchronously of the said control means

15. An image display system as claimed in any preceding claim wherein the said second system is arranged to operate asynchronously of the said first system.

16. An image display system as claimed in any preceding claim wherein the vehicle comprises a plurality of windows and the second system is further arranged to illuminate individual images when individual image and window locations coincide.

17. An image display system as claimed in Claim 16 wherein the second system is arranged to compare in real time the said instantaneous estimated position of the vehicle along the said path with data relating to the position of each image to be illuminated and data relating to the position of individual windows on the vehicle.

18. An image display system as claimed in Claim 17 wherein the second system comprises means for repeatedly identifying, in real time, the next window of the vehicle to pass each of the display images.

19. An image display system as claimed in Claim 18 wherein each individual image is illuminated each time the image and the position of the next window identified to pass that image coincide.

20. An image display system as claimed in Claim 18 or Claim 19 wherein the means for identifying the next window to be identified is updated to identify the next window, for each individual image, each time that image is illuminated.

21. An image display system as claimed in Claim 18 wherein the second system is further arranged to compare the relative position of each image in relation to the instantaneous position of the next window to pass that image each time the said instantaneous estimate of the position of the vehicle is updated by the said first system.

22. An image display system as claimed in any of Claims 17 to 21 wherein the second system is arranged to enable the data relating to the position of the said images to be manipulated to control the illumination of individual images in respective portions of the series of images so that illumination positions of the respective portions, relative to the vehicle, are different for different portions.

23. A control system for an image display system arranged to briefly illuminate successive images of a sequence of images disposed along the path of a vehicle as the vehicle passes; the said system comprising:

means for receiving output signals from at least one detector arranged to detect the arrival of a vehicle and provide repeated measurements of the speed of the vehicle; and,

control means arranged to control the lighting to illuminate images successively as the vehicle passes at illumination timings based on the position of the vehicle along the said path;

wherein the control means comprises processing means including a first system arranged to process the repeated speed measurements to produce an instantaneous estimate of the position of the vehicle along the said path, and a second

system arranged to derive the illumination timings from the instantaneous estimate of the position of the vehicle.

24. A method for controlling an image display system arranged to briefly illuminate successive images of a sequence of images disposed along the path of a vehicle as the vehicle passes; the said method comprising the steps of:

detecting the arrival of a vehicle as it approaches the said sequence of images disposed along the said path;

determining the speed of the vehicle as it passes along the said path;

processing repeated speed measurements to produce an instantaneous estimate of the position of the vehicle along the said path;

controlling lighting arranged to illuminate images successively as the vehicle passes at illumination timings based on the said instantaneous position of the vehicle along the said path.

25. A method as claimed in Claim 24 wherein the step of processing repeated speed measurements includes the step of integrating the measured speed over a defined period of time to determine the distance travelled by the vehicle in that period of time.

26. A method as claimed in Claim 25 wherein the step of processing repeated speed measurements includes the step of loading a first register with values derived from the said repeated speed measurements, and periodically adding the said values of the first register to the contents of a second register loaded with values representing

the instantaneous position of the vehicle along the said path, thereby to periodically update the second register with the instantaneous position of the vehicle.

27. A method as claimed in Claim 26 wherein the steps of determining the measured speed of the vehicle and the step of determining the instantaneous position of the vehicle are asynchronous.

28. A method as claimed in any of Claims 25 to 27 further comprising the steps of determining the acceleration of the vehicle as it passes along the path and processing repeated acceleration measurements to provide a second order estimate of the said instantaneous position based on the measured acceleration and speed of the vehicle.

29. A method as claimed in Claim 28 when dependent directly or indirectly on Claim 26 wherein the step of processing repeated acceleration measurements includes the step of loading a further register with values derived from the said repeated acceleration measurements, and periodically adding the said values of the said further register to the contents of the said first register, thereby to periodically update the first register with the instantaneous speed of the vehicle.

30. A method as claimed in any of Claims 24 to 29 further comprising the step of comparing, in real time, the said instantaneous estimated position of the vehicle along the said path with data relating to the position of each image to be illuminated and data relating to the position of individual windows on the vehicle.

31. A method as claimed in Claim 30 further comprising the step of repeatedly identifying, in real time, the next window of the vehicle to pass each of the display images.

32. A method as claimed in Claim 31 wherein each individual image is illuminated each time the image and the position of the next window identified to pass that image coincide.

33. A method as claimed in Claim 31 or Claim 32 wherein the identity of the next window to pass an image is updated, for each individual image in the series of images, each time that image is illuminated.

34. An image display system as claimed in Claim 31 further comprising the step of comparing the relative position of each image in relation to the instantaneous position of the next window to pass that image each time the said instantaneous estimate of the position of the vehicle is updated.

35. A method as claimed in any of Claims 24 to 34 further comprising the step of processing data relating to the position of the said images to control the illumination of individual images in respective portions of the series of images so that illumination positions of the respective portions, relative to the vehicle, are different for different portions.

36. A method as claimed in Claim 35 wherein the step of processing data relating

to the position of the said images comprises the step of applying a mapping function, including one or more offset values, to the said image position data to move the illumination positions of the respective portions relative to the vehicle.

37. A system for determining the arrival of a specified feature on a vehicle at one or more points along a predetermined path of the vehicle, the system comprising:

sensor means for detecting the arrival of a feature on a vehicle at the or each point along the path and generating a detection signal;

timing means for storing a timing signal representing the time of detection of the feature; and

comparison means for comparing the duration of the or each detection signal with a predetermined threshold duration known to be generated by the specified feature, thereby determining the validity of the or each timing signal.

38. A system as claimed in Claim 37, in which the sensor means comprise a plurality of sensors positioned a predetermined distance apart along the vehicle path.

39. A system as claimed in claim 38, further comprising processing means for determining the speed of the vehicle using validated timing signals from adjacent sensors.

40. A system as claimed any of claims 37 to 39, in which the sensor means comprise light beam sensors.

41. A system as claimed in Claim 40, in which the sensor light beam is unidirectional.

42. A system as claimed in Claim 40, in which the sensor light beam is bi-directional.

43. A system as claimed in any of claims 40 to 42, in which the detection signal is generated upon occlusion of the light beam by the feature of the vehicle.

44. A system as claimed in any of Claims 40 to 42, in which the detection signal is generated upon clearing of the light beam following occlusion.

45. A system as claimed in any of Claims 37 to 44, in which the apparatus is adapted for use with a train travelling along a track.

46. A system as claimed in any of Claims 37 to 45, in which the specified feature comprises the front of the vehicle.

47. A system as claimed in any of Claims 37 to 45, in which the specified feature comprises the back of the vehicle.

48. Apparatus as claimed in any of claims 37 to 47, in which the vehicle comprises a plurality of carriages.

49. A system as claimed in Claim 48, in which the specified feature comprises the

back or front of a carriage.

50. A method of determining the arrival of a specified feature on a vehicle at one or more points along a predetermined path of the vehicle, comprising the steps of:

detecting the arrival of a feature on a vehicle at the or each point along the path and generating a detection signal;

storing a timing signal representing the time of detection of the feature; and

comparing the duration of the or each detection signal with a predetermined threshold duration based on a detection signal known to be generated by the specified feature, thereby determining the validity of the or each timing signal.

51. A method as claimed in Claim 50 in which the vehicle comprises a train.

52. A method as claimed in Claim 50 or Claim 51, in which the specified feature comprises the front or the back of the vehicle.

53. A method as claimed in any of Claims 50 to 52, in which the vehicle comprises a plurality of carriages.

54. A method as claimed in Claim 53, in which the specified feature comprises the back or front of a carriage.

55. A method as claimed in any of Claim 50 to 54, further comprising the step of determining the validity of a plurality of timing signals for a plurality of points a

predetermined distance apart and using them to determine the position, speed and/or acceleration of the vehicle.

56. A display system comprising a digital display device operable to display an image, a speed detector operable to produce a speed signal indicative of the speed of a vehicle having a window passing the display device, a vehicle detector operable to produce a position signal indicative of the position of the vehicle relative to the display device, and processing means connected to receive a signal from the speed detector indicative of the speed of the vehicle and a signal from the vehicle detector indicative of the position of the vehicle window relative to the display device, and operable to displace the image along the display device as the vehicle passes the display device such that the location of the vehicle window and the location of the image on the display device coincide.

57. A display system according to Claim 56 wherein the image comprises a series of frames making up a film sequence wherein the display device is operable to display the next frame in the series at a position on the display device relative to the position at which the previous frame was displayed determined by the speed of the vehicle as the vehicle passes the display device such that as each frame is displayed in sequence, the location of each frame on the display device coincides with the position of the vehicle window as the vehicle passes the display device .

58. A display system according to Claim 56 or Claim 57 wherein the vehicle comprises a plurality of windows such that an image is displayed on the digital display

device to coincide with the position of each window of the vehicle.

59. A display system according to any one of Claims 56 to 58 wherein the display device comprises a single digital display screen.

60. A display system according to any one of Claims 56 to 58 wherein the display device comprises a plurality of digital display screens.

61. A display system according to Claim 60 wherein the screens are arranged substantially adjacent one another.

62. A display system according to Claim 61 wherein the screens are arranged such that the adjacent edges of neighbouring screens abut one another.

63. A display system according to any one of Claims 60 to 62 wherein an image is displayed on the display device such that a single frame spans across more than one display screen.

64. A display system according to any one of Claims 56 to 63 wherein the digital display screen comprises an LCD screen or a TFT screen.

65. A method of displaying an image comprising the steps of

- providing a digital display device operable to display an image thereon;
- providing a speed detector operable to produce a speed signal

indicative of the speed of a vehicle passing the display device;

- providing a vehicle detector operable to produce a position signal indicative of the position of the vehicle relative to the display device;

- providing processing means in connection with the speed detector and the vehicle detector and operable to receive a signal indicative of the speed of the vehicle and a signal indicative of the position of the vehicle; and

- generating an output signal to displace the image along the digital display device as the vehicle passes the display device such that the position of the vehicle window and the location of the image on the digital display device coincide, the image being displayed by means of a back illumination flash.

66. A method according to Claim 65 wherein the image comprises a series of frames making up a film sequence wherein the position at which the next frame in the series is displayed on the display device relative to the position at which the previous frame was displayed is determined by the speed of the vehicle as the vehicle passes the display device such that as each frame is displayed in sequence, the location of each frame on the display device coincides with the position of the vehicle window as the vehicle passes the display device.

67. A method according to Claim 65 or Claim 66 wherein the display device comprises a single display screen.

68. A method according to Claim 65 or Claim 66 wherein the display device comprises a plurality of digital screens.

69. A method according to Claim 68 wherein the screens are arranged substantially adjacent one another.

70. A method according to Claim 69 wherein the screens are arranged such that the adjacent edges of neighbouring screens abut one another.